Scintigraphic Demonstration of Lower Extremity Periostitis Secondary to Venous Insufficiency

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The scintigraphic findings on bone imaging in two patients with extensive lower extremity periostitis secondary to venous insufficiency are presented. One of these patients had bilateral disease. The use of [^{67}Ga]citrate scanning in an attempt to exclude concurrent osteomyelitis is also addressed.

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The development of extensive lower extremity periosteal reaction secondary to venous insufficiency is well known on radiography, but previously unreported on bone scintigraphy. While the pathogenesis of this phenomenon is uncertain, it may be related to hypoxia from venous stasis (*1*). Infection is not generally present; however, as these patients often have skin breakdown, superimposed osteomyelitis cannot always be excluded by clinical findings alone. We report two cases which illustrate the scintigraphic findings of this form of periostitis on technetium-99m (^{99m}Tc) methylene diphosphonate (MDP) bone scanning and the use of gallium-67 (^{67}Ga) citrate in one of these cases.

CASE 1

A 61-yr-old black woman with a 40-yr history of lower extremity venous insufficiency presented with multiple large pretibial skin ulcerations. The patient had been refractory to conventional treatment for the last 12 yr and had undergone three unsuccessful attempts at skin grafting, the most recent being 2 yr prior to admission. She also was involved in a motor vehicle accident 16 yr previously, suffering fractures of her right tibia and fibula which healed uneventfully. The patient had no known systemic disease or family history of sickle cell anemia.

On physical examination, her lower extremities showed brawny induration and discoloration. Twenty-centimeter ulcerations were noted on the medial and lateral aspects of both lower extremities just superior to the ankle joints. There was malodorous purulent drainage from these wounds. The patient was afebrile. Initial WBC count was 22,900/cu mm. Wound cultures grew a mixed flora.

Treatment consisting of elevation, whirlpool treatments, and intravenous antibiotics was instituted. The WBC count decreased to 7,700/cu mm. The initial imaging study obtained, a [^{99m}Tc]MDP bone scan, showed symmetrical increased activity on the dynamic flow images presumably secondary to venous stasis and extensive periosteal activity in both lower extremities below the knees on the 3-hr delayed images (Fig. 1). Subsequent conventional radiographs of this area demonstrated thick undulating periosteal reaction typical of periostitis from venous insufficiency (Fig. 2). A [^{67}Ga] citrate scan of the lower extremities was performed in an attempt to exclude concurrent areas of osteomyelitis. However, there was a large amount of soft-tissue and pericortical activity in the regions of abnormal bone scan uptake (Fig. 3). These abnormal areas of ^{67}Ga uptake could not clearly be distinguished from areas of abnormal [^{99m}Tc]MDP uptake and, therefore, the ^{67}Ga scan was not useful in excluding concurrent osteomyelitis. The patient's subsequent clinical course, however, effectively excluded this diagnosis. A stocking-like distribution of activity representing exudation of ^{67}Ga bound to plasma protein onto the bandages overlying the patient's extensive skin ulcerations was observed.

CASE 2

An 85-yr-old black female with a 20-yr history of venous insufficiency in the left lower extremity presented with a 13-cm ulcer overlying the medial aspect of the left distal tibia which had been refractory to treatment. She had undergone three prior unsuccessful attempts at skin grafting. Her past

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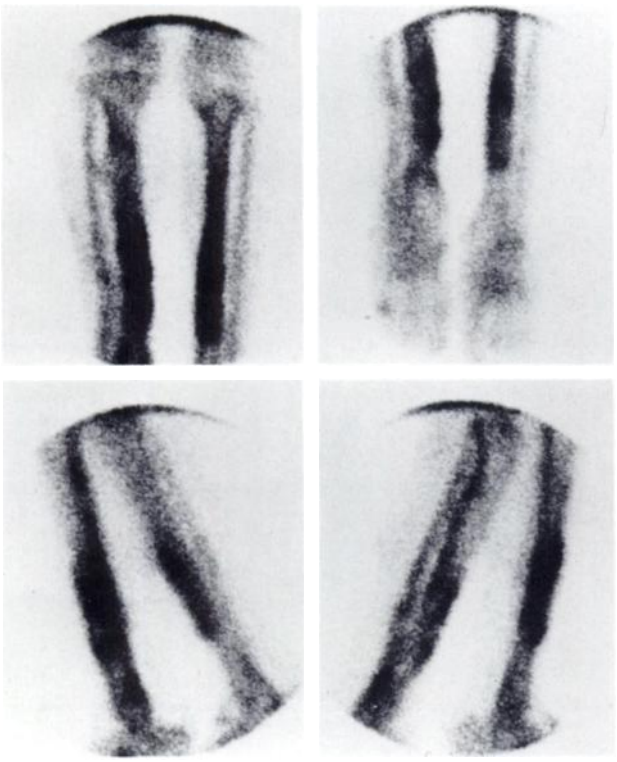

FIGURE 1
Bone scintigraphy (Case 1) Three-hour delayed images showing extensive areas of increased activity in the lower extremities in a distribution corresponding to the periosteum.

FIGURE 2
Corresponding radiographs (Case 1) of the lower extremities demonstrate bilateral thick, undulating periosteal reaction in keeping with long standing venous insufficiency. There is a solid coat of periosteal new bone surrounding

medical history and family history were otherwise unremarkable. The patient complained of recently increased pain and wound drainage, but denied fever or chills. The leukocyte count on admission was 6,000/cu mm. Intravenous antibiotics, whirlpool, and local treatment were started. A bone scan performed on the third hospital day showed increased pericortical activity in the left tibia and fibula, on the 3-hr delayed images (Fig. 4). Radiographs were subsequently obtained and showed thick periosteal new bone formation on both the medial and lateral aspects of the left tibia and fibula (Fig. 5).

DISCUSSION

Chronic deep venous insufficiency of the lower extremity is a relatively common clinical disorder affecting 7 million people in the United States (*2*). Most cases are felt to represent the sequelae of previous acute deep venous thrombosis as over 80% of the patients relate such a history (*3*). Clinical signs such as cyanosis, edema, and stasis skin changes may not appear until 10 to 15 yr after the thrombotic event. Skin ulceration, usually appearing in the lower third of the leg, is often a complication of venous insufficiency and is a cause of significant morbidity. Intractable cases may eventually require below the knee amputation.

On radiographic examination, 10% to 60% of patients with chronic disabling venous stasis develop thick undulating periosteal bone proliferation in the affected lower extremities (*1*). The periosteal reaction may be severe at sites distant from the ulcerations or may not be associated with ulceration at all. Although soft-tissue inflammation is often present, infection is not a prerequisite for the appearance of these bony changes. Local hypoxia has been implicated in the pathogenesis of this type of periostitis since arterial insufficiency has been associated with similar changes. This theory is further supported by the fact that hypertrophic osteoarthropathy, which is radiographically similar in appearance to periostitis from venous insufficiency, can be seen in patients with cyanotic congenital heart disease. In both conditions, the periosteal reaction tends to be thick and widespread indicating a disease process of long duration (*4*).

Pathophysiologically, the sequence of events leading to hypoxia and skin ulceration in chronic venous insufficiency may also be responsible for the observed skeletal changes. Incompetence of the deep venous valves results in venous hypertension and capillary proliferation. This is accompanied by altered capillary dynamics allowing for permeation of large molecules such as fibrinogen and red cells into the extravascular space. There is subsequent deposition of fibrin in the pericapillary regions forming a barrier to the exchange of gasses and nutrients. Suppressed fibrinolytic activity in these patients may also play a role (*3*). It is reasonable to expect these changes to also interfere with the periosteal

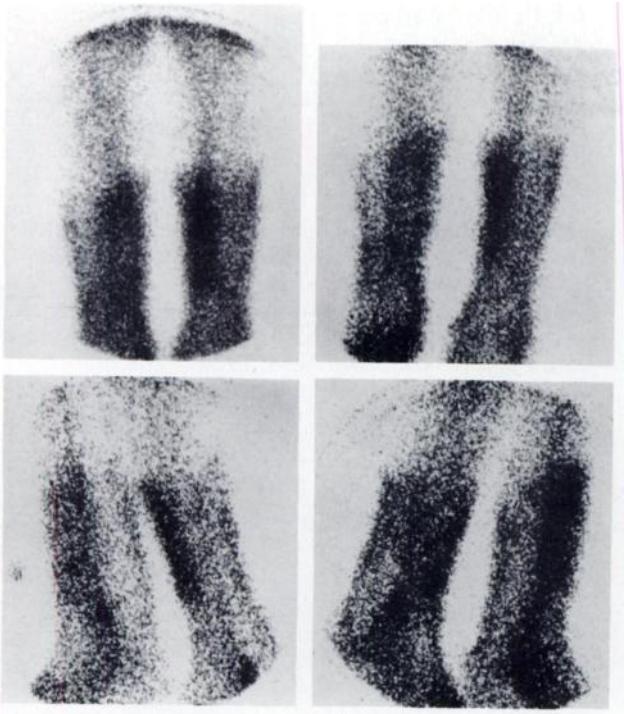

FIGURE 3
48-hr gallium-67 images in similar projections as bone scan (Case 1) images demonstrate primarily soft tissue and pericortical activity. Note the exudation of gallium onto overlying bandages causing a stocking-like pattern.

FIGURE 5
Radiograph of left lower extremity in Case 2. Thick periosteal reaction is seen along the tibia and fibula.

blood supply which in turn elicits osteoid formation and mineralization.

Multiple etiologies for bilateral lower extremity uptake on bone scintigraphy have been described including stress fractures, Paget's disease, multiple myeloma, fibrous dysplasia, and other condition (*5,6*). A periosteal pattern of increased activity has been described in hypertrophic osteoarthropathy, pachydermoperiostosis and thyroid acropachy (*7–11*). This distinctive pattern of increased activity has been termed the "double stripe" or "parallel track" sign. We have been unable to find previous reports describing this finding secondary to periostitis caused by chronic venous insufficiency. The lack of previous reports is somewhat surprising in view of the frequency with which the radiographic changes in this condition are present. This can, perhaps, be explained by the fact that these changes are long standing and the periosteal process may often not be active enough to show increased uptake on the bone scan. Indeed, in Case 2, the amount of increased activity was considerably less than in Case 1, although the radiographic abnormalities were similar. A prospective study correlating bone scintigraphy with radiography in patients with known lower extremity venous insufficiency would be helpful for further defining the true scintigraphic incidence of these changes.

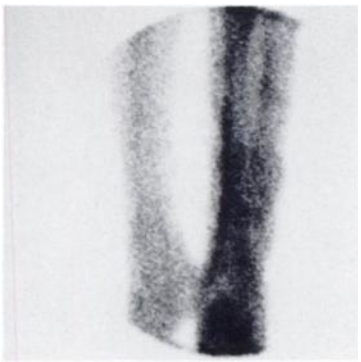

FIGURE 4
Bone scintigraphy, Case 2. Single three hour AP image of left leg shows a ribbon-like area of mildly increased activity corresponding to the periosteum of the medial aspect of the tibia. A lesser degree of increased activity is also noted in the lateral aspect of the tibia and the fibula.

Osteomyelitis is usually not a clinical consideration in most of the other entities with similar scintigraphic findings. However, in periostitis secondary to venous insufficiency the possibility of superimposed bone infection must be considered since the patients often have exudative ulcerations in the region of the abnormal tracer uptake. The use of [^{67}Ga]citrate scanning to exclude osteomyelitis in one of these cases was not helpful, but may be of benefit in some instances.

In our two cases, bone scintigraphy was obtained prior to the radiographs. Therefore, familiarity with this entity as well as correlating abnormal scans with radio-

graphs is important to prevent the inaccurate reporting of probable osteomyelitis in all patients with leg ulcers and increased uptake on bone scintigraphy.

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